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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,438	06/26/2001	James L. Foran	1452.3270001	9657

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EXAMINER	
YANG, RYAN R	
ART UNIT	**PAPER NUMBER**
2628	

MAIL DATE	DELIVERY MODE
10/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/888,438	FORAN, JAMES L.	
	Examiner	Art Unit	
	Ryan R. Yang	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-5,7,9,10 and 13-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-5,7,9,10 and 13-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/1/2007 has been entered.

2. This action is responsive to communications: Amendment, filed on 8/1/2007. This action is non-final.

3. Claims 2-5, 7, 9-10 and 13-16 are pending in this application. Claims 3 and 9 are independent claims. In the Amendment, filed on 8/1/2007, claims 2-5, 7 and 9-10 were amended, and claims 13-16 were added.

4. The present title of the invention is "Method and system for presenting three-dimensional computer graphics images using multiple graphics processing units" as filed originally.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 2-3, 5, 7, 9-10 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel et al. (6,532,017) and further in view of Kunimatsu et al. (6,587,110).

7. As per claim 3, Knittel et al. (6,532,017), hereinafter Knittel, discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising the steps of:

(1) allocating, to the multiple graphics processing units, three-dimensional computer graphics data such that said allocated three-dimensional computer graphics data corresponds to a portion of a scene that lies within rectangular subvolumes to which the multiple graphics processing units have been assigned (Figure 7, V-Bus to 210; "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipelines are the graphics processing units);

(2) rendering, by the multiple graphics processing units, said allocated three-dimensional computer graphics data (where each pipeline can perform "interpolation, classification, gradient estimation, illumination, and compositing", Abstract);

(3) combining said rendered three-dimensional computer graphics data, thereby producing a three-dimensional computer graphics image (Figure 4 29 "the colors, levels of brightness, and transparencies assigned to all of the samples along all of the rays are applied as illustrated at 29 to a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32 for display on image plane 16", column 9, line 34-40, where the compositing unit is considered combiner); and

(4) presenting, for viewing, said combined three-dimensional computer graphics image (Figure 4, item 32).

Knittel discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units.Knittel also discloses subdivision of rectangular subvolume (Figure 2). It is noted that Knittel does not explicitly disclose "wherein a measure of a first dimension of a first rectangular subvolume of the rectangle subvolumes is different from a measure of the first dimension of a second rectangle subvolume of the rectangular subvolume", however, this is known in the art as taught by Kunimatsu et al., hereafter Kunimatsu. Kunimatsu discloses a method of processing image data are divided into subspace (Figure 4B), and the size of the areas allocated to the processors can be adjusted according to the processing time of the processors (column 26, line 48-55).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kunimatsu into Knittel because Knittel discloses a method of presenting three-dimensional computer graphics and Kunimatsu discloses the image area could be adjusted according to the processing time in order to reduce the processing time.

8. As per claim 2, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses loading, into memory cells accessible by the multiple graphics processing units, the three-dimensional computer graphics data corresponding to the portion of the scene that lies within the rectangular subvolumes to which the multiple graphics processing unit units have been assigned (Figure 6, item 204, "section memory 204 is used to store sections of a volume during rendering of the volume data set by the VRC", column 14, line 47-48 and Fig. 10 depicts loading of the subvolume to memory).

9. As per claim 5, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses combining further comprises the step of:

(5) blending said rendered three-dimensional computer graphics data (Figure 4, item 29, "a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32", column 9, line 36-39).

10. As per claim 9, Knittel discloses a system for presenting three-dimensional computer graphics images, comprising:

memory for storing three-dimensional computer graphics data (Figure 14, item 100);

at least one graphics processing unit for rendering a portion of the three-dimensional computer graphics data that corresponds to rectangular subvolumes to which said at least one graphics processing unit is assigned (Figure 7, V-Bus to 210; "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipelines are considered at least one graphics processing unit);

a bus for communicating a viewing position to each of said at least one graphics processing unit, wherein the viewing position determines an aspect of the set of three-dimensional computer graphics data to be rendered ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU); and

at least one image combiner for combining the three-dimensional computer graphics data rendered by said at least one graphics processing unit to produce a three-dimensional computer graphics image (Figure 14 has a plurality of Compositing Unit).

Knittel discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units.Knittel also discloses subdivision of rectangular subvolume (Figure 2). It is noted that Knittel does not explicitly disclose "wherein a measure of a first dimension of a first rectangular subvolume of the rectangle subvolumes is different from a measure of the first dimension of a second rectangle subvolume of the rectangular subvolume", however, this is known in the art as taught by Kunimatsu et al., hereafter Kunimatsu. Kunimatsu discloses a method of processing image data are divided into subspace (Figure 4B), and the size of the areas allocated to the processors can be adjusted according to the processing time of the processors (column 26, line 48-55).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kunimatsu into Knittel because Knittel discloses a method of presenting three-dimensional computer graphics and Kunimatsu discloses the image area could be adjusted according to the processing time in order to reduce the processing time.

11. As per claim 10, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 9, and Knittel further discloses said memory comprises memory cells such that each of said memory cells is accessible by only one of said at least one graphics processing unit ("The voxels are supplied to the pipelines 210-0-212-3, respectively, in 4-voxel groups in a scanned order", column 15, line 9-11).

12. As per claim 13, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses

(5) determining a viewing position (Figure 1 where the view direction determines a viewing position); and

(6) communicating said determined viewing position to the multiple graphics processing units ("All of the calculations for data positions having a given x coefficient modulo 4 are processed by the same rendering pipeline", column 15, line 11-16);

13. As per claim 14, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses wherein said combining is performed by at least one image combiner (Figure 4, the composition unit 124).

14. As per claim 7, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 14, and Knittel further discloses wherein each of the at least one image combiner has an associated frame buffer for storing said combined three-dimensional computer graphics image (Figure 14, item 200 where the pixel memory stores said combined three-dimensional computer graphics image)

15. Claims 4, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel and Kunimatsu as applied to claim 14 above, and further in view of Kaufman et al. (5,760,781).

16. As per claim 4, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 13.

Knittel and Kunimatsu disclose a method for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that

Knittel and Kunimatsu do not explicitly disclose "(7) ordering said rendered three-dimensional computer graphics data based on locations between said determined viewing position and the rectangular subvolumes to which the multiple graphics processing units have been assigned". However, this is known in the art as taught by Kaufman in (Figure 1, item 6; "The conveyer 10 performs a deskewing operation in order to match the physical sequential order of the input modules of the ray projection tree 6 to the sequential order of the voxels of each viewing ray", column 2, line 3-6, where the deskewing operation is an ordering operation).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kaufman into Knittel and Kunimatsu because Knittel and Kunimatsu disclose a method of presenting three-dimensional computer graphics and Kaufman discloses the image is combined in sequential order in order to generate a three-dimensional image related to a projection array

17. As per claim 15, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 14.

Knittel and Kunimatsu disclose a method for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "an output of the at least one image combiner is an input for another image combiner", however, this is known in the art as taught by Kaufman. Kaufman discloses a method of volume visualization in which the voxel data is combined hierarchically (Figure 6 where voxel combination unit 38 is considered an image combiner and a voxel is considered a subvolume of a image).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kaufman into Knittel and Kunimatsu because Knittel and Kunimatsu disclose a method of presenting three-dimensional computer graphics and Kaufman discloses the image is combined in several stages in order to quickly generate a three-dimensional image.

18. As per claim 16, Knittel and Kunimatsu demonstrated all the elements as disclosed in the rejected claim 9.

Knittel and Kunimatsu disclose a method for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "at least one of said at least one image combiner is configured to receive an output of at least one other of said at least one image combiner", however, this is known in the art as taught by Kaufman. Kaufman discloses a method of volume visualization in which the voxel data is combined hierarchically (Figure 6 where voxel combination unit 38 is considered an image combiner and a voxel is considered a subvolume of a image).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kaufman into Knittel and Kunimatsu because Knittel and Kunimatsu disclose a method of presenting three-dimensional computer graphics and Kaufman discloses the image is combined in several stages in order to quickly generate a three-dimensional image.

Response to Arguments

19. Applicant's arguments with respect to claims 3 and 9 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan R. Yang whose telephone number is (571) 272-7666. The examiner can normally be reached on M-F 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi can be reached on (571) 272-7664. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ryan Yang
Primary Examiner
October 6, 2007